NI 3100/3110

User Manual

May 2009
372273A-01

NATIONAL INSTRUMENTS™

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Electromagnetic Compatibility Information

This hardware has been tested and found to comply with the applicable regulatory requirements and limits for electromagnetic compatibility (EMC) as indicated in the hardware's Declaration of Conformity (DoC)[1]. These requirements and limits are designed to provide reasonable protection against harmful interference when the hardware is operated in the intended electromagnetic environment. In special cases, for example when either highly sensitive or noisy hardware is being used in close proximity, additional mitigation measures may have to be employed to minimize the potential for electromagnetic interference.

While this hardware is compliant with the applicable regulatory EMC requirements, there is no guarantee that interference will not occur in a particular installation. To minimize the potential for the hardware to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this hardware in strict accordance with the instructions in the hardware documentation and the DoC[1].

If this hardware does cause interference with licensed radio communications services or other nearby electronics, which can be determined by turning the hardware off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna of the receiver (the device suffering interference).
- Relocate the transmitter (the device generating interference) with respect to the receiver.
- Plug the transmitter into a different outlet so that the transmitter and the receiver are on different branch circuits.

Some hardware may require the use of a metal, shielded enclosure (windowless version) to meet the EMC requirements for special EMC environments such as, for marine use or in heavy industrial areas. Refer to the hardware's user documentation and the DoC[1] for product installation requirements.

When the hardware is connected to a test object or to test leads, the system may become more sensitive to disturbances or may cause interference in the local electromagnetic environment.

Operation of this hardware in a residential area is likely to cause harmful interference. Users are required to correct the interference at their own expense or cease operation of the hardware.

Changes or modifications not expressly approved by National Instruments could void the user's right to operate the hardware under the local regulatory rules.

[1] The Declaration of Conformity (DoC) contains important EMC compliance information and instructions for the user or installer. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

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About This Manual

This manual contains detailed instructions for installing and configuring your National Instruments NI 3100/3110 industrial controller kit.

How to Use the Documentation Set

Begin by reading the *NI 3100/3110 Installation Guide*, a brief quick-start guide that describes how to install and get started with your controller.

This manual, the *NI 3100/3110 User Manual*, contains more details about changing the installation or configuration from the defaults and using the hardware.

Conventions

The following conventions appear in this manual:

»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
	This icon denotes a note, which alerts you to important information.
	This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.
bold	Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.
italic	Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

monospace bold Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

Related Documentation

The following documents contain information you may find helpful as you read this manual:

- *PCI Local Bus Specification*, Revision 2.3, PCI Special Interest Group
- *Serialized IRQ Support for PCI Systems Specification*, Revision 6.0, Compaq Computer et al.
- *Universal Serial Bus (USB) Specification*, Revision 2.0
- *Digital Visual Interface (DVI) Specification*, Revision 1.0
- *PCI Express Base Specification*, Revision 1.1, PCI Special Interest Group
- *CompactFlash Specification*, Revision 4.1, CompactFlash Association

1

Introduction

This chapter contains an overview of the NI 3100/3110 and related National Instruments software.

NI 3100/3110

Description

The NI 3100/3110 is a high-performance, small, fanless embedded computer designed for rugged industrial applications. The NI 3100 has an Intel Celeron-M423 (1.06 GHz single-core processor), standard PC I/O, and a 80 GB or larger hard drive. The NI-3110 has an Intel Core Duo processor L2400 (1.66 GHz Core Duo processor), standard PC I/O, and a 80 GB or larger hard drive. Both have a CompactFlash expansion slot. Variants of the NI 3100/3110 for use with LabVIEW RT include a 1 GB solid state hard drive (SSHD) instead of a regular hard drive.

Functional Overview

This section contains functional descriptions of each major logic block on the NI 3100/3110 industrial controller.

NI 3100/3110 Functional Description

The NI 3100/3110 is a complete modular PC in a small, rugged enclosure. Figure 1-1 is a functional block diagram of the NI 3100/3110. Following the diagram is a description of each logic block shown.

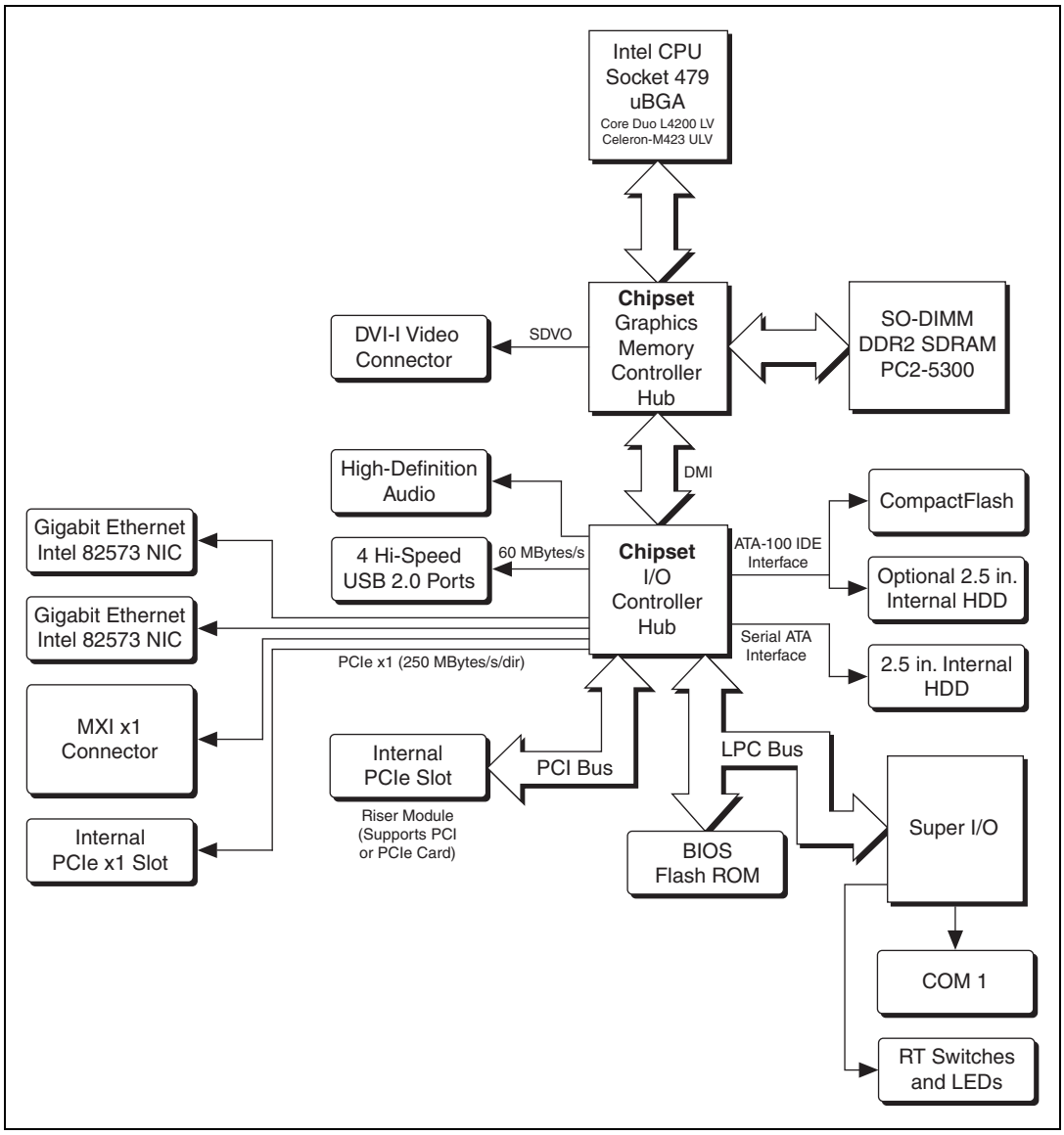


Figure 1-1. NI 3100/3110 Block Diagram

The NI 3100/3110 consists of the following logic blocks on the CPU and I/O module:

- *Intel CPU Socket-479* is the socket definition for the Intel Core Duo processor L2400 or Intel single-core Celeron-M423.
- The *SO-DIMM* block consists of a single 64-bit DDR-2 667 SDRAM socket that can hold up to 1 GB of memory.
- The *945GMCH* (Graphics and Memory Controller Hub) connects the CPU, DDR2 SDRAM, and DVI-I video.
- The *ICH7M* connects the PCI, PCI Express, USB, IDE, SATA, and LPC buses.
- The high-speed USB 2.0 ports are connected to the ICH7M.
- The *Super I/O* block represents other peripherals supplied by the NI 3100/3110, including the serial port, RT switches, and LEDs.
- The dual *Gigabit Ethernet* provides either 10, 100, or 1000 Mbit Ethernet interfaces.
- The *SATA* block connects a Serial ATA hard drive to the ICH7M.
- The *ATA-100 IDE* block connects an internal ATA-compatible 2.5 in. hard drive (optional). The IDE feature is built into the chipset. The slave port on the IDE block is connected to the internal CompactFlash slot to support the removable CompactFlash memory card.
- The *high-definition audio* block consists of a stereo line-level input and a stereo line-level output using an AC-97-compliant CODEC.
- The *MXI x1 external connector* is a x1 cabled MXI Express connector for external peripherals.
- The *Internal PCIe x1 socket* and *Internal PCI socket* support either one half-length PCI expansion card or one half-length PCI Express expansion card via a dedicated riser card (supplied).
- The *Video section* uses the Intel GMA-950 integrated graphics driver to support dual monitors via a DVI-I connector.

National Instruments Software

National Instruments has developed several software tools you can use with the NI 3100/3110.

National Instruments hardware and software work together to help you make the most of your system. The LabVIEW, Measurement Studio, and LabWindows™/CVI™ application development environments combine with leading hardware drivers such as NI-DAQmx to provide exceptional control of NI hardware. Instrument drivers are available at `ni.com/devzone/idnet` to simplify communication with instruments over a variety of buses.

LabVIEW is a powerful and easy-to-use graphical programming environment you can use to acquire data from thousands of different instruments including USB, IEEE 488.2, VXI, serial, PLCs, and plug-in boards. LabVIEW helps you convert acquired data into meaningful results using powerful data analysis routines. Add-on tools provide additional specialized functionality. For more information, visit `ni.com/labview` and `ni.com/toolkits`.

If you prefer to use Microsoft Visual Basic, Visual C++, and Visual Studio .NET for the core of your application, Measurement Studio adds tools for measurement and automation to each language. For more information, visit `ni.com/mstudio`.

LabWindows/CVI is an interactive ANSI C programming environment designed for building virtual instrument applications. LabWindows/CVI delivers a drag-and-drop editor for building user interfaces, a complete ANSI C environment for building your test program logic, and a collection of automated code generation tools, as well as utilities for building automated test systems, monitoring applications, or laboratory experiments. For more information, visit `ni.com/lwcvi`.

NI-DAQmx provides an extensive library of functions, such as NI Signal Express, that you can call from your application development environment or interactive environment. These functions provide an intuitive API for National Instruments multifunction DAQ products. Features available include analog input (A/D conversion), buffered data acquisition (high-speed A/D conversion), analog output (D/A conversion), waveform generation, digital I/O, counter/timer operations, SCXI signal conditioning, RTSI or PXI synchronization, self-calibration, messaging, and acquiring data to extended memory. For more information, visit `ni.com/daq`.

National Instruments Modular Instruments use specialized drivers suited to each product's specialization. Express VIs provide customized, interactive programming of instruments in a single interface, and soft front panels provide an interface for testing the functionality of each instrument with no programming required. NI Switches, DMMs, High-Speed DIO, High-Speed Digitizers, and Sources each have customized drivers for high-end modular instrumentation systems. RF applications leverage two drivers, NI-RFSG and NI-RFSA, and Dynamic Signal Acquisition is available through NI-DAQmx. For more information, visit `ni.com/modularinstruments`.

NI-VISA is the National Instruments implementation of the VISA specification. VISA is a uniform API for communicating and controlling USB, Serial, GPIB, PXI, VXI, and various other types of instruments. This API aids in the creation of portable applications and instrument drivers. For information about writing your own PXI instrument driver with NI-VISA, refer to the *NI-VISA Getting Started Manual* and the `readme.txt` file in the NI-VISA directory. For more information, visit `ni.com/visa`.

2

Installation and Configuration

This chapter contains information about installing and configuring your NI 3100/3110 controller.

Mounting the NI 3100/3110

This section contains mounting and installation requirements.

Before mounting the controller, record the serial number and Ethernet Mac address from the bottom plate, as you cannot read these after you mount the controller.

You can mount the controller in any orientation to any material. Do not mount the controller upside down (cooling fins facing down), as this may affect the thermal performance. Measure the ambient temperature 50.8 mm (2 in.) from the front of the controller.

Caution Your installation must meet the following requirements for space and cabling clearance:

- Allow 152.4 mm (6 in.) on the sides and top of the controller for air circulation.
- Allow 101.6 mm (4 in.) in front of the controller for cable clearance for common connectors, such as DVI and serial. Verify the cable clearance requirements for any PCI or PCI Express card installed.

Installing the NI 3100/3110

This section contains general installation instructions for the NI 3100/3110.

Cautions Be sure the NI 3100/3110 is powered down and the AC input to the external power supply is disconnected before connecting or disconnecting any connectors. The computer boots and runs as soon as power is applied; there is no on/off switch.

Also, ground the unit to minimize the possibility of static electricity damage and ground yourself with antistatic straps or work in an antistatic approved area when inserting or removing an internal PCI or PCI Express peripheral card.

Follow these steps to install the NI 3100/3110:

1. Connect a USB keyboard and USB mouse to any spare USB port, or use a USB to PS/2 adapter (not supplied) to connect a PS/2 keyboard and mouse to a single USB port.
2. Connect a DVI monitor to the DVI connector, or use the DVI splitter cable (supplied) to connect dual monitors. In dual monitor mode, one monitor must support a DVI-D interface and the other must support a VGA analog interface for dual independent displays. You must connect the monitor(s) before powering on the system.
3. Connect devices to other ports as your system configuration requires.
4. If you will use the internal expansion slot, refer to the *Installing an Internal PCI or PCI Express Peripheral Module* section later in this chapter.
5. Connect a 10–30 V, 60 W minimum external DC power supply. Note the connector polarity. There is a separate input for chassis ground, which you can connect to a suitable earth, depending on your application. The input is reverse polarity protected, so if the unit does not power up, be sure you have the correct polarity for the external DC supply.
6. Power on the display(s).
7. Apply AC power to the external DC power supply. There is no power switch.
8. Verify that the controller boots. If the controller does not boot, refer to the *What if the NI 3100/3110 does not boot?* section of Chapter 5, *Troubleshooting*.

BIOS Setup

You can change the NI 3100/3110 configuration settings in the BIOS setup. The BIOS is the low-level interface between the hardware and PC software that configures and tests your hardware when you boot the system. The BIOS setup program includes menus for configuring settings and enabling NI 3100/3110 controller features.

Most users do not need to use the BIOS setup program, as the NI 3100/3110 controller ships with default settings that work well for most configurations.

Caution Changing settings in this menu may result in an unstable or unbootable system. If this happens, follow the instructions for restoring default settings in the *Clearing System CMOS* section. In general, do *not* change a setting unless you are absolutely certain what it does and National Instruments directs you to do so.

Entering BIOS Setup

To start the BIOS setup utility, complete the following steps:

1. Power on or reboot your NI 3100/3110.
2. When the message **`Press <DEL> to enter SETUP`** appears, press <Delete>. The message **`Entering Setup`** appears briefly, and then the BIOS setup program is entered.
3. When you first enter the BIOS program, it displays the **Main** menu.

Use the following keys to navigate through the BIOS setup:

- **Left, right, up, and down arrows**—Use these keys to move between different setup menus. Press <Esc> to exit a submenu. Be sure number lock is off to use the numeric keypad arrows.
- **<Enter>**—Use this key either to complete a submenu or display all available settings for a highlighted configuration option.
- **<Esc>**—Use this key to return to a parent menu of a submenu or cancel an outstanding selection. At the main menu, use this key to exit the BIOS setup.
- **<+>** and **<–>**—Use these keys to cycle between all available settings.
- **<Tab>**—Use this key to select time and date fields. When entering time and date information, you can also use the number keys to enter the time and date directly.

Clearing System CMOS

The NI 3100/3110 contains a battery-backed memory for storing BIOS configuration information.

Follow these steps to clear the CMOS contents:

1. Shut down and remove power from the NI 3100/3110.
2. Turn the NI 3100/3110 upside down (with the heatsink facing downward).
3. Remove the bottom plate from the chassis by removing the eight retaining screws.
4. Disconnect the 2.5 in. HDD or SSHD cable, noting the pin 1 orientation.
5. Locate the jumper for clearing the CMOS contents, as shown in Figure 2-1. (For clarity, the heat spreader is not shown in the figure.)

6. Move the jumper from pins 1–2 to pins 2–3 as shown in Figure 2-1.
7. Wait 30 seconds and move the jumper back to pins 1–2.

Caution Do not leave the jumper on pins 2–3 for any significant length of time. Doing so decreases battery life. In addition, leaving the jumper on pins 2–3 prevents the system from booting.

8. Reconnect the 2.5 in. HDD or SSHD cable, noting the pin 1 orientation.
9. Reattach the bottom plate to the chassis by with the eight retaining screws.
10. Turn the NI 3100/3110 right side up.
11. Reapply power.
12. Enter the BIOS to set time, date, and other parameters.

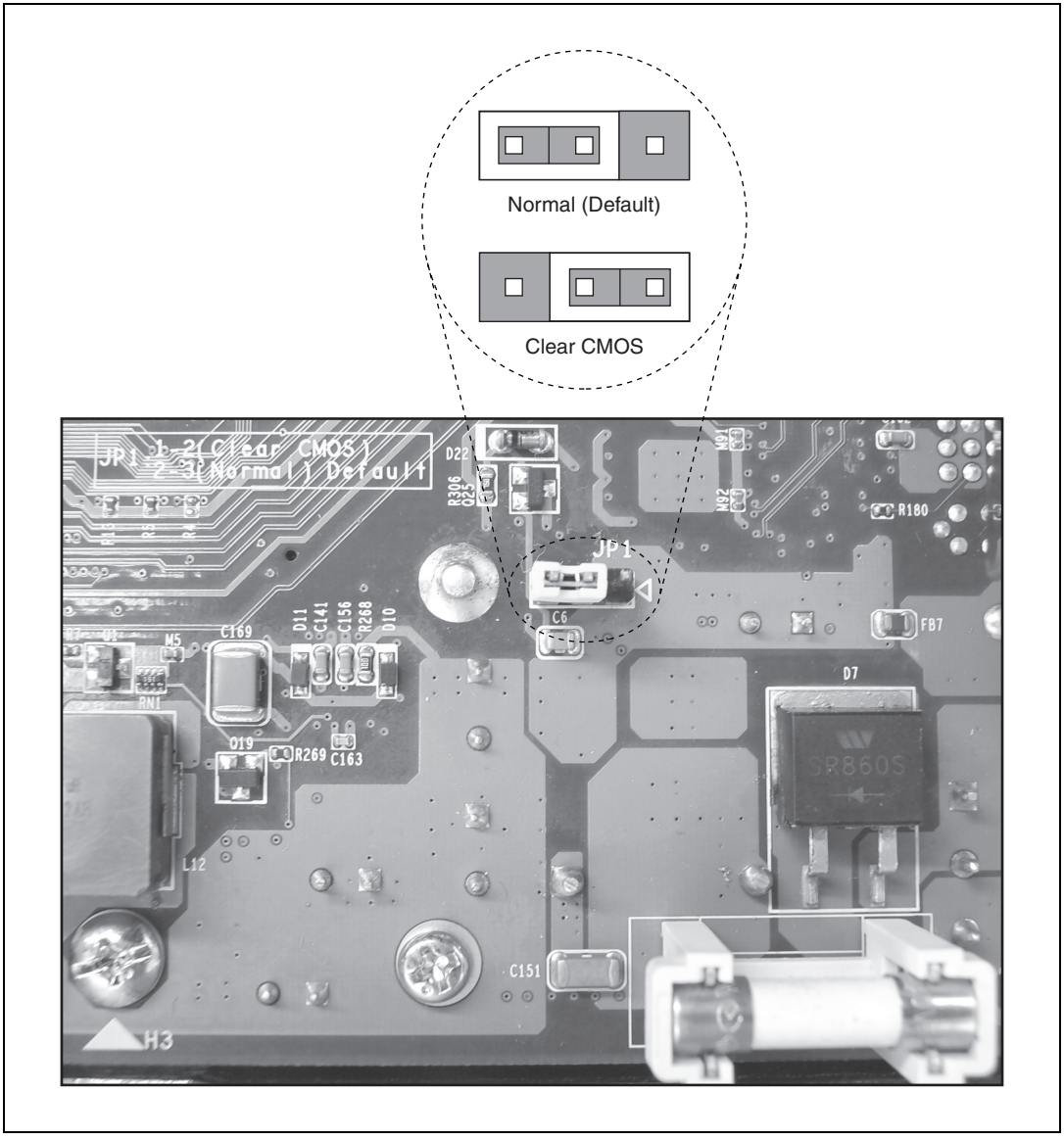


Figure 2-1. Clearing the CMOS Contents

Upgrading RAM

The NI 3100/3110 memory is not field upgradeable. Contact your NI representative for upgrade options.

Installing an Internal PCI or PCI Express Peripheral Module

The NI 3100/3110 can accept a PCI Express or PCI half-length expansion card. (Go to `ni.com/info` and enter `exfnrw` for a list of approved PCI and PCI Express cards for use with the NI 3100/3110.) The riser plugs into the I/O board. The kit includes two risers supplied in the kit, one for PCI and one for PCI Express.

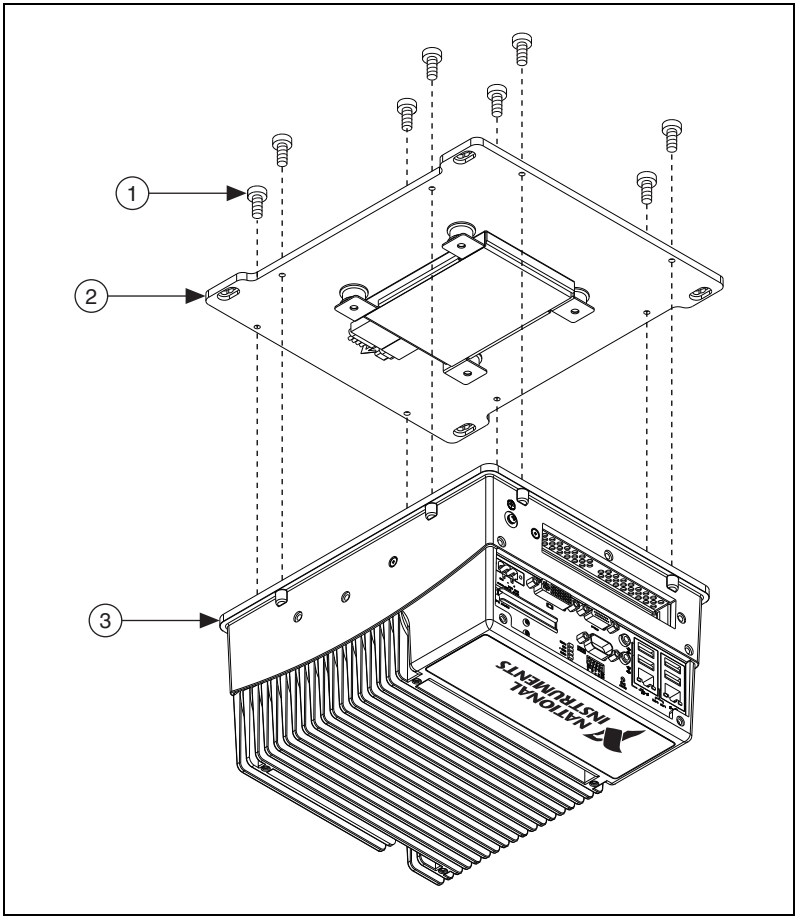
To install an expansion card, you need the following items:

- ❑ NI 3100/3110 industrial controller
- ❑ 2.5 mm hex key
- ❑ #1 Phillips screwdriver
- ❑ 5 mm flat blade screwdriver

Follow these steps to install a PCI Express or PCI expansion card:

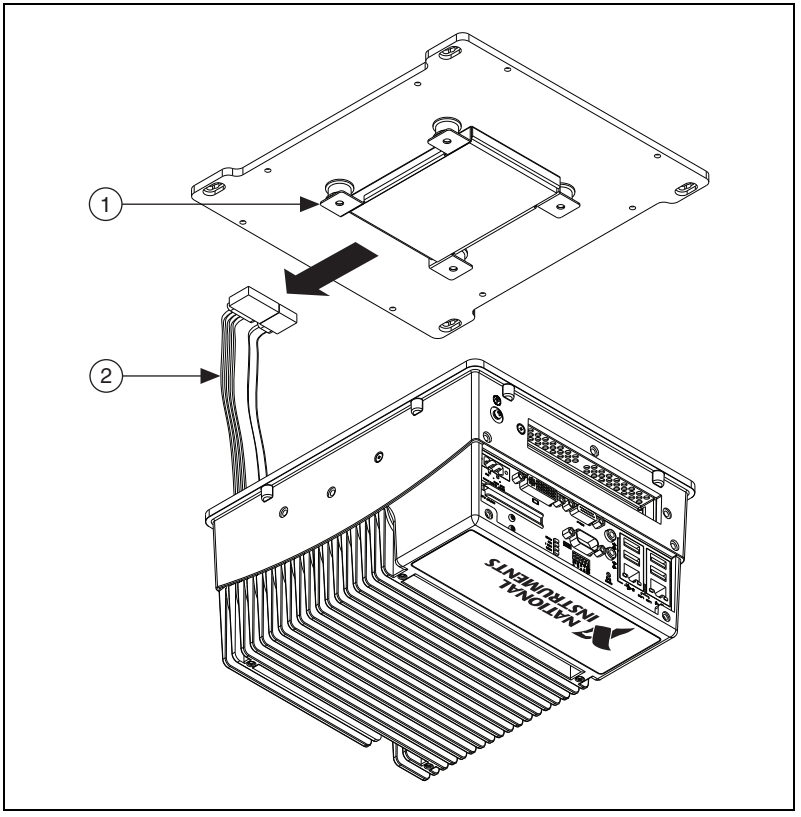
1. Shut down and remove power from the NI 3100/3110.
2. Turn the NI 3100/3110 upside down (with the heatsink facing downward).

3. Remove the bottom plate from the housing by removing the eight retaining screws, as shown in the following figure. Use care when removing the plate to avoid damaging the hard drive or cables.



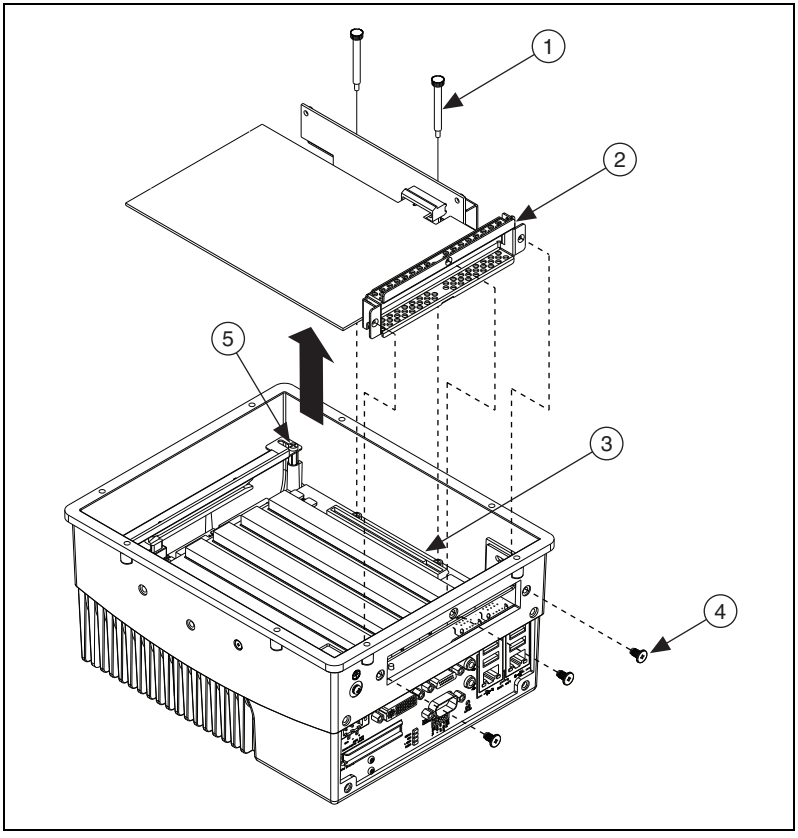
1 Retaining Screw (×8)	2 Bottom Plate	3 Housing

4. Disconnect the 2.5 in. HDD or SSHD cable, noting the cable orientation, as shown in the following figure.



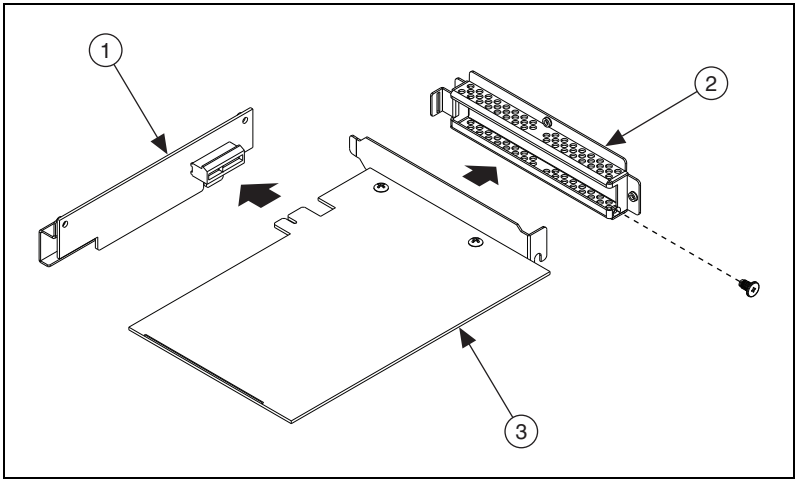
1	Hard Drive	2	HDD/SSHD Cable

5. Remove the riser card assembly (with dummy expansion card) from the I/O board by removing the two riser card retaining screws and three bracket retaining screws. Loosen the two expansion card support bracket screws, as shown in the following figure. Keep these screws in a secure location.



1	Riser card retaining screw (×2)	4	Bracket retaining screw (×3)
2	Riser card assembly	5	Expansion card support bracket screw (×2)
3	Main I/O board		

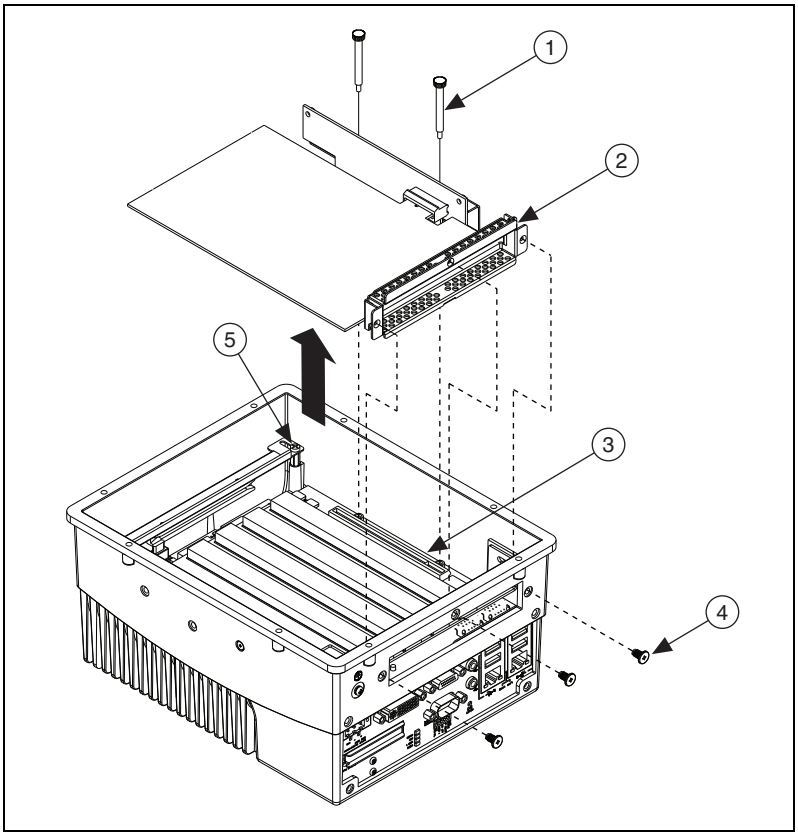
6. Remove the dummy expansion card from the riser card assembly by removing the riser card and the expansion card bracket, as shown in the following figure.



1	PCI Express or PCI riser card	3	Expansion card
2	Expansion card bracket retainer		

7. Mount the expansion card bracket to the retainer, as shown in the preceding figure. Be sure the card bracket is secured to the retainer by tightening the screw to 0.31 N · m (2.7 lb · in.) of torque.
8. Mount the correct PCI Express or PCI riser card onto the expansion card, as shown in the preceding figure.

9. Slide the assembly into the NI 3100/3110, ensuring the riser mates correctly to the main I/O board, as shown in the following figure.



1	Riser card retaining screw (×2)	4	Bracket retaining screw (×3)
2	Riser card assembly	5	Expansion card support bracket screw (×2)
3	Main I/O board		

10. Replace the two screws that hold the riser card onto the I/O board, as shown in the preceding figure. Tighten the two screws to 0.41 N · m (3.6 lb · in.) of torque.
11. Replace the three screws holding the expansion card retainer to the housing. Tighten the three screws to 0.55 N · m (4.9 lb · in.) of torque.
12. Adjust the expansion card support bracket until the expansion card fits snugly. Retighten the two screws securing the bracket to 0.55 N · m (4.9 lb · in.) of torque.
13. Reconnect the 2.5 in. HDD or SSHD cable, noting the cable orientation.

14. Reattach the bottom plate to the chassis by with the eight retaining screws. Tighten the eight screws to 0.55 N · m (4.9 lb · in.) of torque.
15. Place the NI 3100/3110 right side up.

Installing an Operating System

NI 3100/3110 controllers include a preinstalled operating system. In some cases, you may want to install a different operating system. When doing so, consider the following guidelines.

Installing from a CD-ROM

The NI 3100/3110 supports installing Windows Vista/XP from a USB CD-ROM. However, many other operating systems do not support installation from a USB CD-ROM. For example, Windows 2000 aborts during the install process, because it does not include drivers for a USB CD-ROM device.

CompactFlash

This section describes how to install and remove CompactFlash modules.

Installing a CompactFlash Card

Follow these steps to install a CompactFlash card:

1. Remove the locking screw and raise the CompactFlash slot cover door.
2. Hold the card so the top side is facing up.
3. Insert the card until it is completely seated in its connector. (The ejector button protrudes from the unit when the CompactFlash card is correctly seated.)

Note If you encounter too much resistance, do not force the card. Check the card orientation and try again.

4. Lower the cover door and replace the locking screw. This cover prevents inadvertent CompactFlash card ejection.

When running windows, the NI 3100/3110 automatically recognizes IDE-based CompactFlash memory cards and allocates them a drive letter. The CompactFlash card may need to be formatted FAT32 before the drive can be accessed. The unit may need powering off and on for the CompactFlash Card to be visible to the operating system.

Caution Do not insert or remove the CompactFlash card while the system is powered on. Doing so may cause data loss, and in some cases the drive may need reformatting.

Third-party cards may require additional drivers. Contact your CompactFlash vendor for more information.

Caution The CompactFlash interface is ESD sensitive. An electrostatic shock to the CompactFlash module while it is inserted may cause the controller to lock up or reboot, or data loss on a CompactFlash memory card.

Removing a CompactFlash Card

Follow these steps to remove a CompactFlash card:

1. Power down the NI 3100/3110.
2. Remove the locking screw and raise the CompactFlash slot door cover.
3. Push the protruding ejector button. The card should slide forward.

Note If you encounter too much resistance when pushing the ejector button, do not force the card. Check the card slot for obstructions and try again.

4. Remove the card from the slot.
5. Lower the cover door and replace the locking screw.

3

I/O Information

Front Panel Connectors

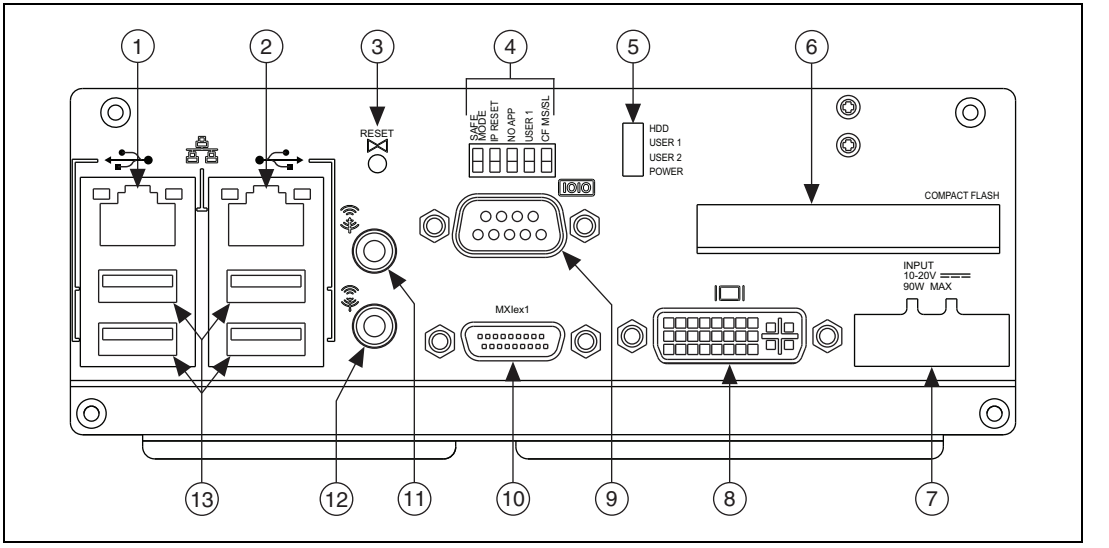
Table 3-1 lists various I/O interfaces and their corresponding NI 3100/3110 external connectors, bus interfaces, and functions.

Table 3-1. NI 3100/3110 I/O Overview

I/O Interface	External Connector	Description
Video	DVI-I (24-pin DSUB)	Intel GMA-950 Extreme Graphics controller
Serial	COM1 (9-pin DSUB)	16550 RS-232 serial port
Ethernet	LAN (RJ45)	10/100/1000 Ethernet connection
USB (four ports)	USB 4-pin Series A stacked receptacle	Hi-Speed USB
CompactFlash	CompactFlash slot	CompactFlash expansion
MXI Express	MXI Express x1	MXI Express x1 connection
Audio	3.5 mm jack	Line-level audio in and out
Power	3-pin power connector	10–30 VDC, 60 W minimum

Front Panel

Figure 3-1 shows the NI 3100/3110 front panel layout.



1	LAN 1 Connector	5	HDD/User 1/User 2/Power LEDs	10	MXI Express x1 Connector
2	LAN 2 Connector	6	CompactFlash Slot	11	Audio In Connector
3	Reset Switch	7	Power Supply Connector	12	Audio Out Connector
4	Safe Mode/IP Reset/No App/ User 1/CF Master/Slave Switches	8	DVI-I Connector	13	USB Connectors
		9	COM1 Connector		

Figure 3-1. NI 3100/3110 Front Panel Layout

DVI-I

Figure 3-2 shows the location and pinouts for the DVI-I connector on the NI 3100/3110. Table 3-2 lists and describes the DVI-I connector signals.

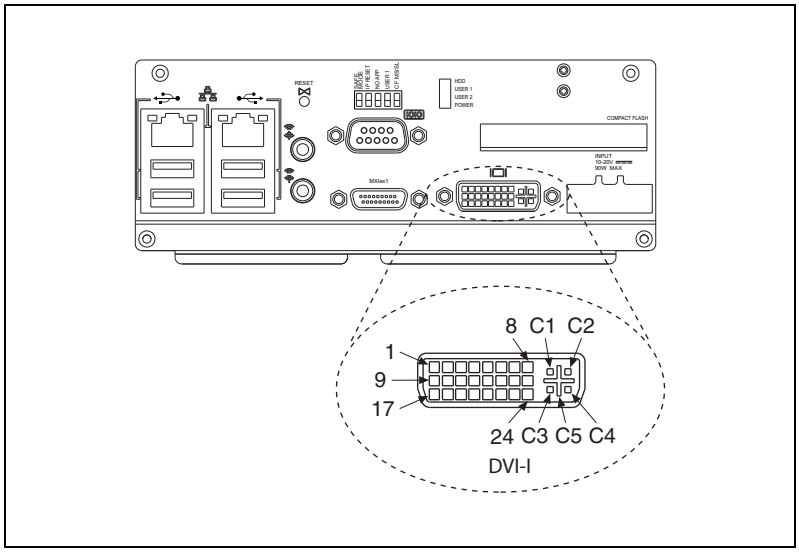


Figure 3-2. DVI-I Connector Location and Pinout

Table 3-2. DVI-I Connector Signals

Pin	Signal Name
1	TMDS Data2–
2	TMDS Data2+
3	TMDS Data2/4 Shield
4	Reserved
5	Reserved
6	DDC Clock [SCL]
7	DDC Data [SDA]
8	Analog Vertical Sync
9	TMDS Data1–
10	TMDS Data1+

Table 3-2. DVI-I Connector Signals (Continued)

Pin	Signal Name
11	TMDS Data1/3 Shield
12	Reserved
13	Reserved
14	+5 V Power
15	Ground (for +5 V)
16	Hot Plug Detect
17	TMDS Data0–
18	TMDSData0+
19	TMDS Data0/5 Shield
20	Reserved
21	Reserved
22	TMDS Clock Shield
23	TMDS Clock+
24	TMDS Clock–
C1	Analog Red
C2	Analog Green
C3	Analog Blue
C4	Analog Horizontal Sync
C5	Analog GND Return: (analog R, G, B)

COM1

Figure 3-3 shows the location and pinouts for the COM1 connector on the NI 3100/3110. Table 3-3 lists and describes the COM1 connector signal.

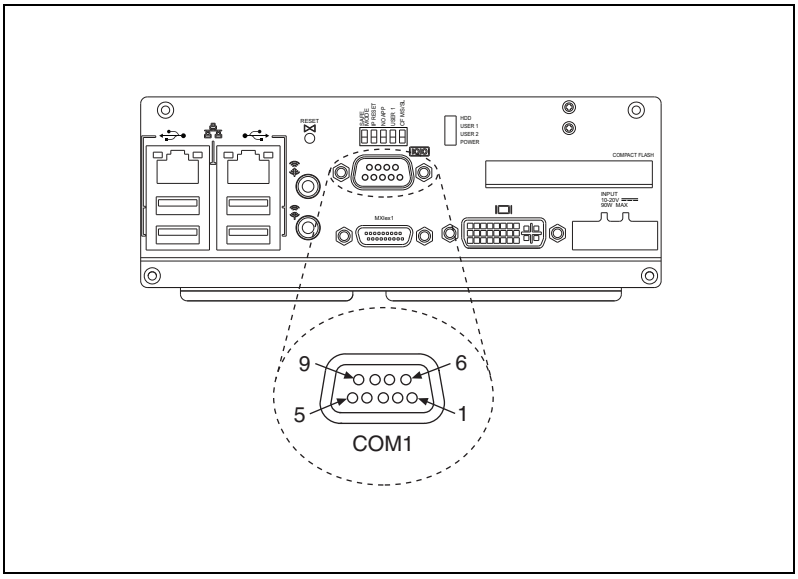


Figure 3-3. COM1 Connector Location and Pinout

Table 3-3. COM1 Connector Signals

Pin	Signal Name	Signal Description
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Ready to Send
8	CTS	Clear to Send
9	RI	Ring Indicator

Ethernet

Figure 3-4 shows the location and pinouts for the Ethernet connector on the NI 3100/3110. Table 3-4 lists and describes the Ethernet connector signals.

Note When using LabVIEW Real Time, you must use the LAN1 port (the port on the left) for discovery and configuration.

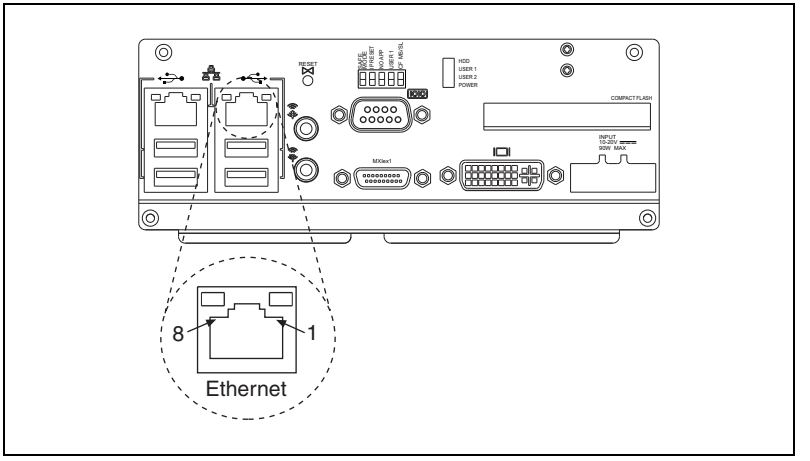


Figure 3-4. Ethernet Connector Location and Pinout

Table 3-4. Ethernet Connector Signals

Pin	Fast Ethernet	Gigabit Ethernet
1	TX+	TX_A+
2	TX–	TX_A–
3	RX+	RX_B+
4	NC	TX_C+
5	NC	TX_C–
6	RX–	RX_B–
7	NC	RX_D+
8	NC	RX_D–

Note The Ethernet controller can perform automatic crossover, thus eliminating the need for crossover cables.

Table 3-5. 10/100/1000 LAN Connector LED States

LED	Color	LED State	Condition
Left	Green	Off	LAN link is not established.
		On (steady state)	LAN link is established.
		On (brighter and pulsing)	The controller is communicating with another computer on the LAN.
Right	Unlit	Off	10 Mbit/s data rate is selected.
	Orange	On	100 Mbit/s data rate is selected.
	Green	On	1000 Mbit/s data rate is selected.

Universal Serial Bus

Figure 3-5 shows the location and pinouts for the Universal Serial Bus (USB) connectors on the NI 3100/3110. Table 3-6 lists and describes the USB connector signals.

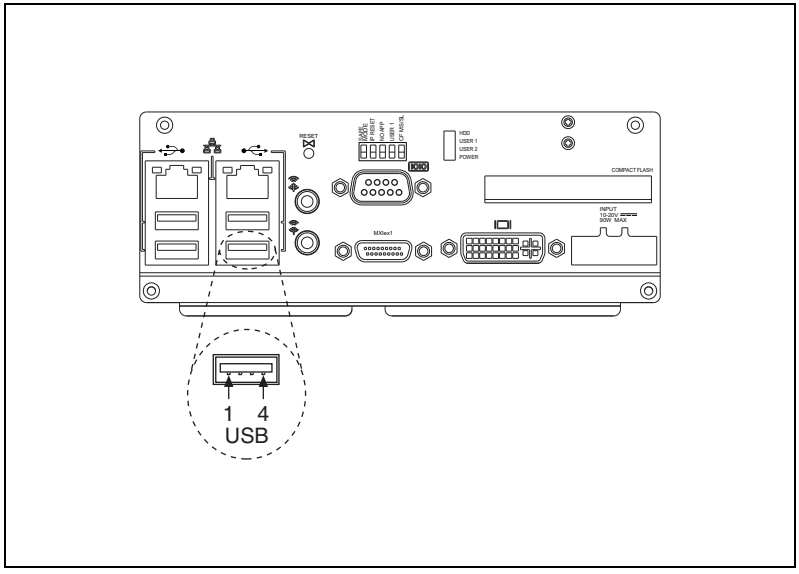


Figure 3-5. USB Connector Location and Pinout

Table 3-6. USB Connector Signals

Pin	Signal Name	Signal Description
1	VCC	Cable Power (+5 V)
2	D–	USB Data–
3	D+	USB Data+
4	GND	Ground

CompactFlash Slot

The NI 3100/3110 controller is equipped with a CompactFlash slot on the front panel, which provides I/O expansion and options for removable storage.

Figure 3-6 shows the location and pinouts for the CompactFlash slot on the NI 3100/3110. Table 3-7 lists and describes the CompactFlash connector signals.

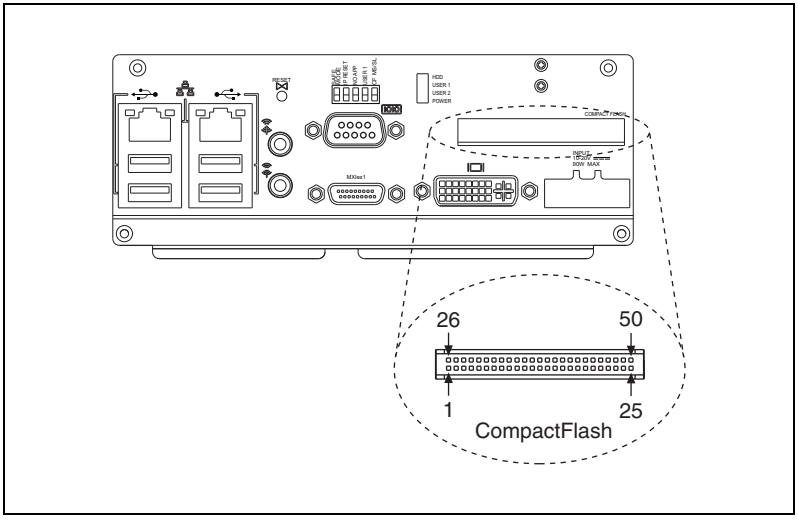


Figure 3-6. CompactFlash Slot Location and Pinout

Table 3-7. CompactFlash Connector Signals

Pin	Signal Name	Signal Description
1	GND	Ground
2	D3	Data 3
3	D4	Data 4
4	D5	Data 5
5	D6	Data 6
6	D7	Data 7
7	/CE1	Card Enable 1
8	A10	Address 10
9	/OE	Output Enable
10	A9	Address 9
11	A8	Address 8
12	A7	Address 7
13	VCC	+5 V
14	A6	Address 6
15	A5	Address 5
16	A4	Address 4
17	A3	Address 3
18	A2	Address 2
19	A1	Address 1
20	A0	Address 0
21	D0	Data 0
22	D1	Data 1
23	D2	Data 2
24	/WP:/IOIS16	Write Protect: IOIS16
25	/CD2	Card Detect 2
26	/CD1	Card Detect 1

Table 3-7. CompactFlash Connector Signals (Continued)

Pin	Signal Name	Signal Description
27	D0	Data 0
28	D0	Data 0
29	D0	Data 0
30	D0	Data 0
31	D0	Data 0
32	/CE2	Card Enable 2
33	/VS1	Refresh
34	/IORD	I/O Read
35	/IOWR	I/O Write
36	/WE	Write Enable
37	/READY:/RDY:/IREQ	Ready: Busy: IREQ
38	VCC	+5 V
39	CSEL	—
40	/VS2	RFU
41	RESET	Reset
42	/WAIT	Wait
43	/INPACK	—
44	/REG	Register Select
45	/BVD2:SPKR	Battery Voltage Detect 2: SPKR
46	/BVD1:STSCHG	Battery Voltage Detect 1: STSCHG
47	D8	Data 8
48	D9	Data 9
49	D10	Data 10
50	GND	Ground

MXI Express x1

Figure 3-7 shows the location and pinouts for the MXI Express x1 connector on the NI 3100/3110. Table 3-8 lists and describes the MXI Express x1 connector signals.

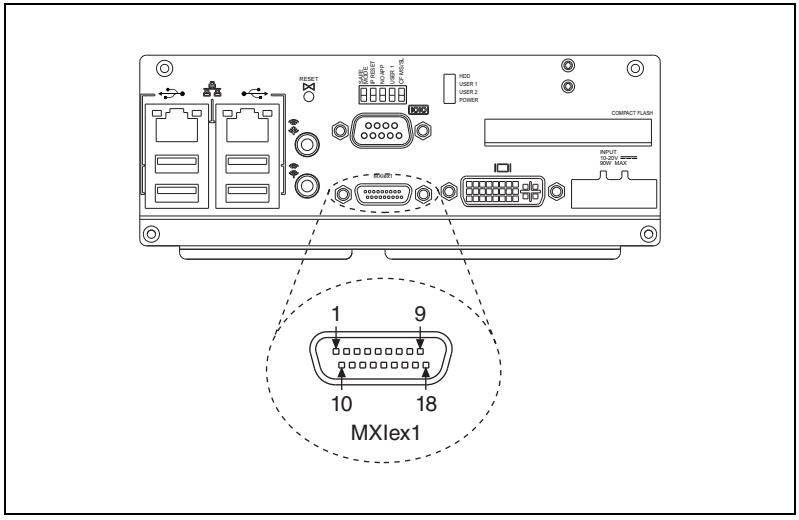


Figure 3-7. MXI Express x1 Connector Location and Pinout

Table 3-8. MXI Express x1 Connector Signals

Pin	Side B Connector		Side A Connector	
	Name	Description	Name	Description
1	+12V	+12 V Power	PRSNT#1	Hot Plug Presence Detect
2	+12V	+12 V Power	+12V	+12 V Power
3	RSVD	Reserved	+12V	+12 V Power
4	GND	Ground	GND	Ground
5	SMCLK	SMBus Clock	JTAG2	TCK
6	SMDAT	SMBus Data	JTAG3	TDI
7	GND	Ground	JTAG4	TDO
8	+3.3V	+3.3 V Power	JTAG5	TMS
9	JTAG1	+TRST#	+3.3V	+3.3 V Power

Table 3-8. MXI Express x1 Connector Signals (Continued)

Pin	Side B Connector		Side A Connector	
	Name	Description	Name	Description
10	3.3Vaux	3.3 V Power	+3.3V	+3.3 V Power
11	WAKE#	Link Reactivation	PWRGD	Power Good
Mechanical Key				
12	RSVD	Reserved	GND	Ground
13	GND	Ground	REFCLK+	Reference Clock Differential Pair
14	HSOp(0)	Transmitter Lane 0, Differential Pair	REFCLK–	
15	HSOn(0)		GND	Ground
16	GND	Ground	HSIp(0)	Receiver Lane 0, Differential Pair
17	PRSNT#2	Hot Plug Detect	HSIn(0)	
18	GND	Ground	GND	Ground

Audio

Figure 3-8 shows the location and pinouts for the audio connectors on the NI 3100/3110. Table 3-9 lists and describes the audio connector signals.

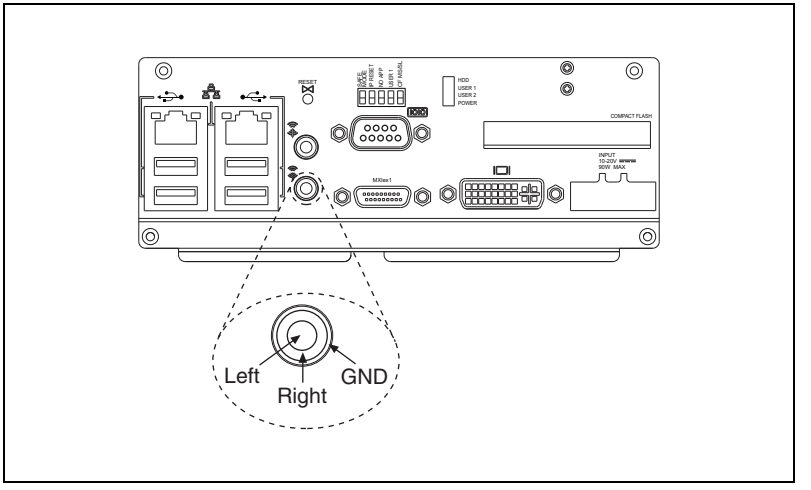


Figure 3-8. Audio Connector Location and Pinout

Table 3-9. Audio Connector Signals

Pin	Signal Name	Signal Description
Tip	Left	Left Audio Channel
Middle	Right	Right Audio Channel
Outer	GND	Ground

Power

Figure 3-9 shows the location and pinouts for the power connector on the NI 3100/3110. (The figure shows the front of the connector attached to the power cable, not the receptor on the NI 3100/3110.) Table 3-10 lists and describes the power connector signals.

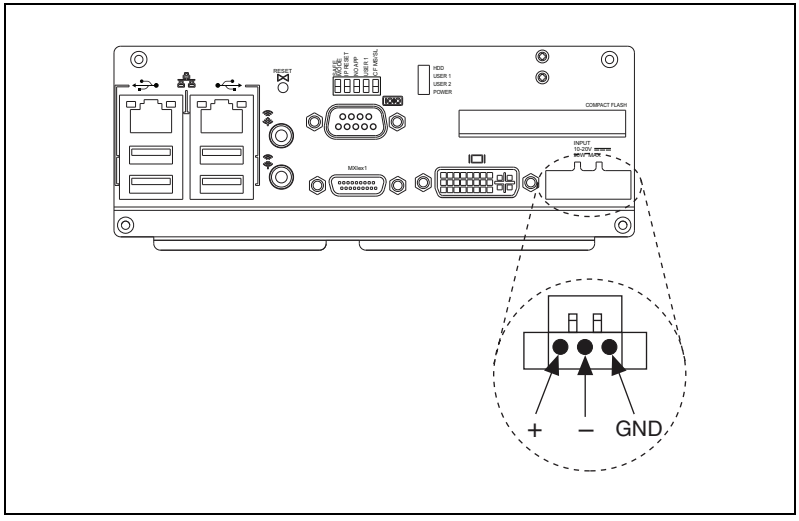


Figure 3-9. Power Connector Location and Pinout

Table 3-10. Power Connector Signals

Pin	Signal Name	Signal Description
1	+	Positive
2	–	Negative
3	GND	Chassis Ground

Front Panel Features

The NI 3100/3110 controller has the following front panel features:

- LEDs
  - **Power LED**—Green when powered on
  - **HDD**—Green when HDD read/write is in progress
  - **User 1**—RT programmable LED
  - **User 2**—RT programmable LED
- Switches
  - **Safe Mode**—Runs LabVIEW Real Time in Safe Mode
  - **IP Reset**—Resets the LabVIEW Real Time IP address to default
  - **No App**—Prevents LabVIEW Real Time from running the user application on startup
  - **User 1**—LabVIEW Real Time-accessible user switch
  - **CF Master/Slave**—Allows the CF slot to be either Master (with no internal IDE drive) or slave (with internal IDE drive)
  - **Reset**—Recessed reset switch; accessible with a ballpoint pen

Data Storage

The NI 3100/3110 has the following data storage features:

- Internal hard drive
  - 2.5 in. notebook
  - Serial ATA (SATA) or parallel ATA (PATA) hard drive or solid state hard drive
- USB storage support—USB CD-ROM, mass storage device, or floppy drive
- Compact Flash slot—Compact Flash storage slot

4

Common Configuration Questions

This chapter answers common configuration questions you may have when using the NI 3100/3110 industrial controller.

General Questions

What do the LEDs on the NI 3100/3110 front panel mean?

Refer to the LED status descriptions in the *Front Panel Features* section of Chapter 3, *I/O Information*.

How do I check the configuration of the memory, hard drive, time/date, and so on?

You can view these parameters in the BIOS setup. To enter the BIOS setup, reboot the NI 3100/3110 and press <Delete> during the memory tests. Refer to the *Entering BIOS Setup* section of Chapter 2, *Installation and Configuration*, for more information.

Can I use the internal hard drive and a CompactFlash drive at the same time?

Yes. However, you must set the CF master/slave switch to slave, and the CF card must be inserted.

Boot Options

What devices can I boot from?

The NI 3100/3110 can boot from the following devices:

- The internal hard drive
- CompactFlash drive
- A network PXE server on the same subnet

- An external USB mass storage device such as a USB hard drive, USB memory stick, or CD-ROM
- An external USB floppy drive
- Most PCI-based boards that provide an Option ROM

Note There are some limitations when booting from a USB device. Windows XP can be installed from a USB CD-ROM, but earlier versions of Windows cannot. The NI 3100/3110 BIOS configures the USB devices so that they will work in a DOS environment.

Cables and Connections

How do I plug both a PS/2 mouse and PS/2 keyboard into the controller?

The NI 3100/3110 has no PS/2 connector, and you need to use a USB Y-splitter cable as shown in Figure 4-1, or a similar device, to connect both a PS/2 mouse and PS/2 keyboard. National Instruments part number 778713-01 is such a cable and is available through the online catalog at `ni.com/products`.

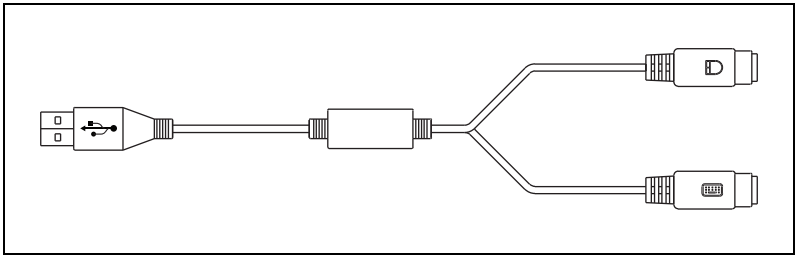


Figure 4-1. Y-Splitter Cable

What if I don't have a Y-splitter cable? Can I still use a mouse and keyboard?

If you do not have a Y-splitter cable, plug a USB keyboard into any USB connector. You can also plug a USB mouse into any USB connector.

How do I connect a VGA monitor to the NI 3100/3110?

A VGA-to-DVI-I adapter (replacement part number 762559-01) is included with your kit. You can use this adapter to connect a VGA monitor to the DVI-I port.

Software Driver Installation

How do I install software from a CD?

The compact size of the NI 3100/3110 does not allow for an integrated CD-ROM drive. You have the following options:

- **USB CD-ROM**—You can install from a USB CD-ROM using a bootable installation CD.
- **Mapped network drive**—You can use Ethernet to connect to another computer. If you share the CD-ROM drive on the other computer, you can map the shared CD-ROM drive to a drive letter on the NI 3100/3110.

Upgrade Information

Where do I get the latest software drivers?

The latest National Instruments software is available from `ni.com/downloads`.

My NI 3100/3110 does not have an internal floppy drive. Is there a way to use an external drive?

Yes. The NI 3100/3110 controller supports and can boot from USB floppy drives. A USB floppy drive will not work with Windows NT4, but will work with Windows 2000 or Windows XP. Refer to the *Boot Options* section for more information.

A USB floppy drive is available from National Instruments, part number 778492-02.

5

Troubleshooting

This chapter answers common troubleshooting questions you may have when using the NI 3100/3110 compact computer.

What if the NI 3100/3110 does not boot?

Several problems can cause a controller not to boot. Here are some things to look for and possible solutions.

Things to Notice:

- Which LEDs come on? The **Power OK** LED should stay lit. The **Drive** LED should blink during boot as the disk is accessed.
- Was the display installed prior to power-on? What appears on the display? Does it hang at some particular point (BIOS, Operating System, and so on)? If nothing appears on the screen, try a different monitor. Does your monitor work with a different PC? If it hangs, note the last screen output that you saw for reference when consulting National Instruments technical support.
- What has changed about the system? Did you recently move the system? Was there electrical storm activity? Did you recently add a new module, memory chip, or piece of software?

Things to Try:

- Make sure the chassis is plugged in to a working power source.
- Check the fuse in the NI 3100/3110 or other power supply.
- Remove any I/O modules from the NI 3100/3110.
- Remove any nonessential cables or devices.
- Clear the CMOS. (Refer to the *Clearing System CMOS* section of Chapter 2, *Installation and Configuration*.)

My controller boots fine until I get to Windows, at which point I cannot read the screen. This may include garbled output, white screen, black screen, or an out of synch message from the monitor.

This problem usually results from having the video card output set past the limits of the monitor. You will need to boot Windows in Safe Mode. To do this, reboot the controller. As Windows begins to boot, hold down <F8>.

You should now be able to reset the video driver to lower settings. Try setting the resolution to 640 × 480 and the refresh rate to 60 Hz. Once you reboot, you can raise these values again, using the test option in Windows. These settings are accessible through the **Advanced** tab of the **Display** item in the **Control Panel**. Alternately, you can try a different monitor, preferably a newer and larger one.

If the system has been booted to Windows without a monitor attached, the driver may have defaulted to the video output connector being disabled. Press <Ctrl-Alt-F1> to re-enable the video display in Windows. Press <Ctrl-Alt-F4> to re-enable a DVI display. For more information, refer to KnowledgeBase 3OHCFRD8 at `ni.com/support`.

My CMOS is corrupted. How do I set it back to default?

1. Shut down and remove power from the NI 3100/3110.
2. Turn the NI 3100/3110 upside down (with the heatsink facing downward).
3. Remove the bottom plate from the chassis by removing the eight retaining screws.
4. Disconnect the 2.5 in. HDD or SSHD cable, noting the pin 1 orientation.
5. Locate the jumper for clearing the CMOS contents, as shown in Figure 5-1. (For clarity, the heat spreader is not shown in the figure.)
6. Move the jumper from pins 1–2 to pins 2–3 as shown in Figure 5-1.
7. Wait 30 seconds and move the jumper back to pins 1–2.

Caution Do not leave the jumper on pins 2–3 for any significant length of time. Doing so decreases battery life. In addition, leaving the jumper on pins 2–3 prevents the system from booting.

8. Reconnect the 2.5 in. HDD or SSHD cable, noting the pin 1 orientation.
9. Reattach the bottom plate to the chassis by with the eight retaining screws.
10. Turn the NI 3100/3110 right side up.
11. Reapply power.
12. Enter the BIOS to set time, date, and other parameters.

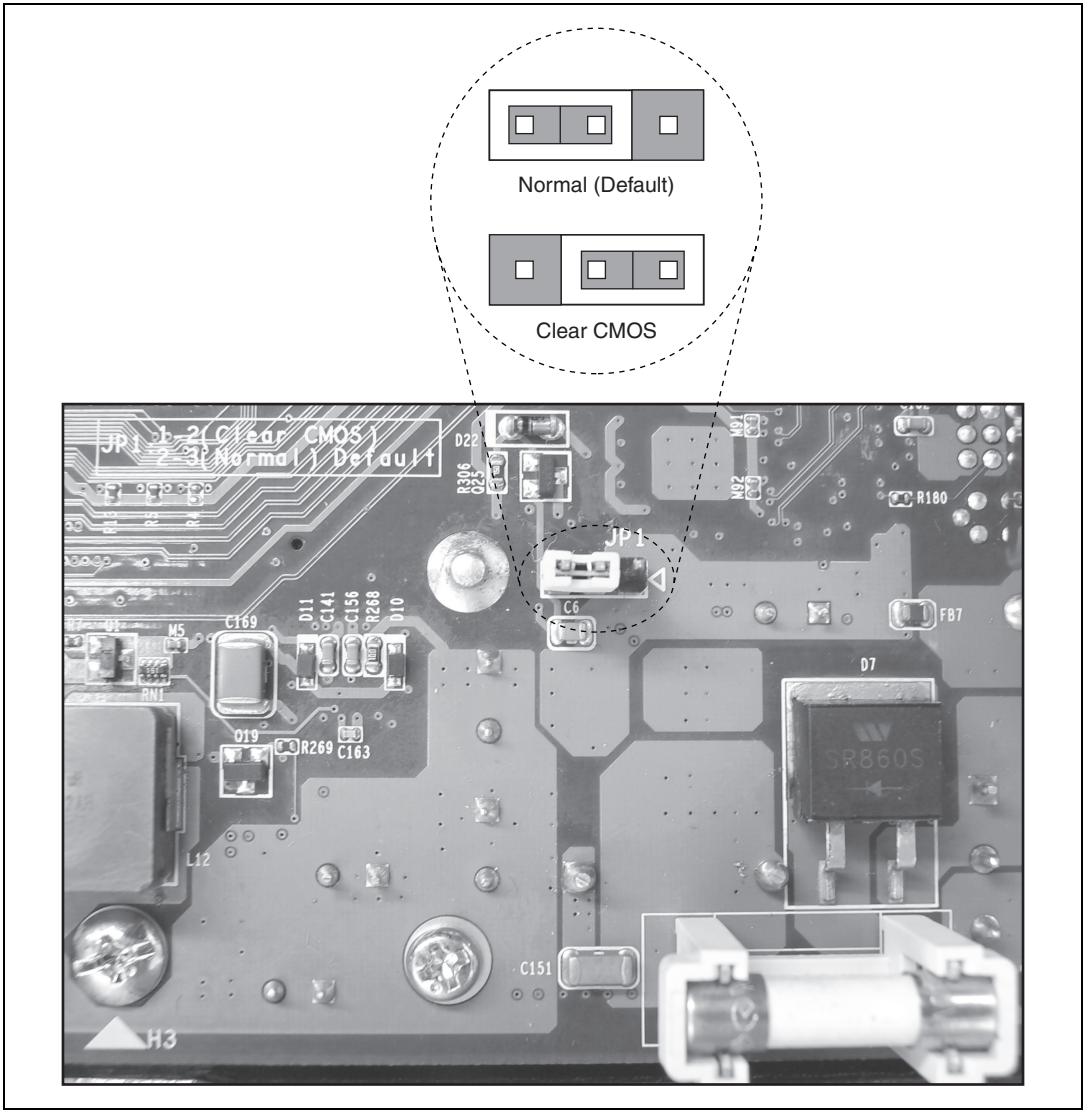


Figure 5-1. Clearing the CMOS Contents

A

Specifications

This appendix lists the electrical, mechanical, and environmental specifications of the NI 3100/3110 embedded computer.

Electrical

Voltage ..... 10–30 VDC

Power ..... 40 W maximum
(no PCI card installed)

Physical

Unit dimensions ..... Custom size
110 cm × 200 cm × 220 cm
(4.3 in. × 7.9 in. × 8.66 in.)

Weight ..... 3.63 Kg (8.0 lb) maximum
(no PCI card installed)

Screw terminal wiring ..... 16–12 AWG copper conductor wire with 8 mm (0.31 in.) of insulation stripped from the end.

Torque for screw terminals ..... 0.51 N · m (4.5 lb · in.)

Environment

Maximum altitude ..... 2,000 m (at 25 °C ambient temperature)

Pollution Degree 2

Indoor use only.

Operating Environment

Ambient temperature range

Operating Temperature Range (Deg C)	PCI or PCI Express Card Installed (< 10 W)?
0–50	No
0–45	Yes

Go to `ni.com/info` and enter `exfnrw` for a list of approved PCI and PCI Express cards for use with the NI 3100/3110.

Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.

Relative humidity range.....10% to 90%, noncondensing
(Tested in accordance with IEC-60068-2-56.)

Caution Clean the NI 3100/3110 with a soft nonmetallic brush. Make sure that the device is completely dry and free from contaminants before powering-on the controller again.

Storage Environment

Ambient temperature range .....–40 to 70 °C
(Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

Relative humidity range.....5% to 95% noncondensing
(Tested in accordance with IEC-60068-2-56.)

Shock and Vibration

Operational shock ..... 30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)

Random vibration

- Operating ..... 5 to 500 Hz, 0.3 g_{rms} (with solid-state hard drive)
- Nonoperating ..... 5 to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

To meet these shock and vibration specifications, you must panel mount or wall mount the NI 3100/3110, affix ferrules to the ends of all terminal wires, and install tie wraps on the Ethernet and power cables.

Safety

This product meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 60950-1, EN 60950-1
- UL 60950-1, CSA 60950-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 55024: Industrial Immunity
- EN 55022 (CISPR 22): Group 1, Class A emissions
- AS/NZS CISPR 22: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at `ni.com/environment`. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit `ni.com/environment/weee`.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

B

Technical Support and Professional Services

Visit the following sections of the award-winning National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Technical support at ni.com/support includes the following resources:
  - **Self-Help Technical Resources**—For answers and solutions, visit ni.com/support for software drivers and updates, a searchable KnowledgeBase, product manuals, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on. Registered users also receive access to the NI Discussion Forums at ni.com/forums. NI Applications Engineers make sure every question submitted online receives an answer.
  - **Standard Service Program Membership**—This program entitles members to direct access to NI Applications Engineers via phone and email for one-to-one technical support as well as exclusive access to on demand training modules via the Services Resource Center. NI offers complementary membership for a full year after purchase, after which you may renew to continue your benefits.

    For information about other technical support options in your area, visit ni.com/services, or contact your local office at ni.com/contact.
- **Training and Certification**—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. You also can register for instructor-led, hands-on courses at locations around the world.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, National Instruments Alliance Partner members can help. To learn more, call your local NI office or visit ni.com/alliance.

- **Declaration of Conformity (DoC)**—A DoC is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting `ni.com/certification`.
- **Calibration Certificate**—If your product supports calibration, you can obtain the calibration certificate for your product at `ni.com/calibration`.

If you searched `ni.com` and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Symbol	Prefix	Value
n	nano	10^{-9}
μ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^{3}
M	mega	10^{6}
G	giga	10^{9}
T	tera	10^{12}

Symbols

°	Degrees.
Ω	Ohms.
%	Percent.

A

A	Amperes.
AC	Alternating Current.
ASIC	Application-specific integrated circuit.

B

B	Bytes.
backplane	An assembly, typically a printed circuit board, with connectors and signal paths that bus the connector pins.
BIOS	Basic Input/Output System—BIOS functions are the fundamental level of any PC or compatible computer. BIOS functions embody the basic operations needed for successful use of the computer's hardware resources.

C

C	Celsius.
cache	Small portion of high-speed memory used for temporary storage of frequently used data.
CMOS	Complementary Metal Oxide Semiconductor—A type of integrated circuit.
CompactPCI	An adaptation of the PCI specification for industrial and/or embedded applications that require a more robust mechanical form factor than desktop PCI. CompactPCI provides a standard form factor for those applications requiring the high performance of PCI as well as the small size and ruggedness of a rack-mount system.
Controller	An embedded computer module which configures and accesses a series of devices connected to a chassis backplane.

D

DC	Direct Current.
DDR2	Double Data Rate, 2nd generation.
DIMM	Dual In-line Memory Module.
DMA	Direct Memory Access—A method by which data is transferred between devices and internal memory without intervention of the central processing unit.

DRAM	Dynamic RAM (Random Access Memory)—Storage that the computer must refresh at frequent intervals.
DVI-I	Direct Video Interface, Integrated—A video technology enabling the use of both analog and digital video signals.

E

ECP	Extended Capabilities Parallel.
EEPROM	Electronically Erasable Programmable Read Only Memory.
EMC	Electromagnetic Compatibility.
EMI	Electromagnetic interference.
EPP	Enhanced Parallel Port.
expansion ROM	An onboard EEPROM that may contain device-specific initialization and system boot functionality.

F

FCC	Federal Communications Commission.

G

g	1. Grams. 2. A measure of acceleration equal to 9.8 m/s^2.
GPIB	General Purpose Interface Bus (IEEE 488).
g_{rms}	A measure of random vibration—The root mean square of acceleration levels in a random vibration test profile.

H

Hz	Hertz—Cycles per second.

I

I/O	Input/output—The techniques, media, and devices used to achieve communication between machines and users.
IDE	Integrated Drive Electronics—Hard disk and built-in controller.
IEEE	Institute of Electrical and Electronics Engineers.
in.	Inches.
instrument driver	A set of routines designed to control a specific instrument or family of instruments, and any necessary related files for LabWindows/CVI or LabVIEW.
interrupt	A means for a device to request service from another device.
interrupt level	The relative priority at which a device can interrupt.
IRQ#	Interrupt request signal.
ISA	Industry Standard Architecture—The original PC bus architecture, specifically the 16-bit AT bus.

K

kB	Kilobytes of memory.

L

LAN	Local Area Network—Communications network that serves users within a confined geographical area. It is made up of servers, workstations, a network operating system, and a communications link.
LED	Light-emitting diode.

M

m	Meters.
master	A functional part of a PXI device that initiates data transfers on the PXI backplane. A transfer can be either a read or a write.

MB	Megabytes of memory.
MTBF	Mean time between failure.
MTTR	Mean time to repair.

N

NI-488 or NI-488.2	The National Instruments software for GPIB systems.
NI-DAQ	The National Instruments software for data acquisition instruments.
NI-VISA	The National Instruments implementation of the VISA standard—An interface-independent software that provides a unified programming interface for VXI, GPIB, and serial instruments.
NMI	Non-maskable interrupt—High-priority interrupt that cannot be disabled. It is used to report malfunctions such as parity, bus and math coprocessor errors.

P

PCI	Peripheral Component Interconnect—The PCI bus is a high-performance 32-bit or 64-bit bus with multiplexed address and data lines.
PCI Express	Peripheral Component Interconnect Express—A faster, serialized version of the PCI bus.
PCMCIA	Personal Computer Memory Card International Association.
peripheral	Any hardware device connected to a computer, such as a monitor, keyboard, printer, plotter, disk or tape drive, graphics tablet, scanner, mouse, and so on.
POSC	Power On Self Configuration.
PXI	PCI eXtensions for Instrumentation—An open implementation of CompactPCI that adds electrical features that meet the high-performance requirements of instrumentation applications by providing triggering, local buses, and system clock capabilities. PXI also offers two-way interoperability with CompactPCI products.

R

RAM	Random Access Memory—the computer's primary workspace.
RAMDAC	Random Access Memory Digital to Analog Converter—the VGA controller chip that maintains the color palette and converts data from memory into analog signals for the monitor.
resource	Hardware settings used by devices in a computer system, including ISA interrupt level, DMA channel, and I/O address.
RMS	Root mean squared. *See also* g_{rms}.
RTC	Real Time Clock—An electronic circuit that maintains the time of day and also can provide timing signals for timesharing operations.

S

s	Seconds.
slave	A functional part of a PXI device that detects data transfer cycles initiated by a PXI bus master and responds to the transfers when the address specifies one of the device's registers.
SO-DIMM	Small Outline Dual In-line Memory Module.
SRAM	Static RAM—A memory chip that requires power to hold its content. It does not require refresh circuitry as a dynamic RAM chip, but it does take up more space and uses more power.

U

USB	Universal Serial Bus.

V

V	Volts.
VGA	Video Graphics Array—The minimum video display standard for all PCs.

W

W	Watts.

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